Is My Well Water Safe to Drink?: Characterizing Arizona's Groundwater Quality

Douglas Towne and Jason Jones
Arizona Department of Environmental Quality

#1 – Why Characterize Arizona's Groundwater Quality?

Groundwater is Arizona's most important water source, providing 46 percent of the state's annual use.

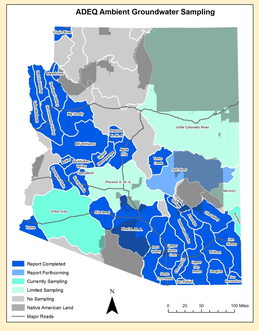
One in 20 Arizonans use a private well for their drinking water. These 114,000 wells have no testing requirements.

Those using private domestic wells may be unaware of the health impacts of their water source, making **reliable information on water quality essential to protect public health**.

#2 – How Does ADEQ Characterize Groundwater Quality?

ADEQ's Ambient Groundwater Monitoring program **sampled 1,766 wells and springs** from 1995-2015. Domestic, irrigation, stock, and municipal wells were included.

All samples were analyzed for EPA SDW inorganic constituents. Lesser numbers of samples were collected for radionuclides, VOCs, and pesticide analysis.

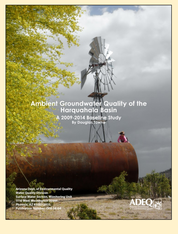


Initial data interpretation revealed that Arizona groundwater quality is generally **more variable spatially than over time**.

The program is currently characterizing **the state's 51 groundwater basins**.

ADEQ has sampled 39 basins and published reports on 33 basins.

Studies are on the ADEQ website as both **reports** and **fact sheets.**



#3 – What is Arizona's Groundwater Quality?

The **1,766 sites** sampled were compared to health-based Primary Maximum Contaminant Levels (MCLs) and aesthetics-based Secondary MCLs water quality standards:

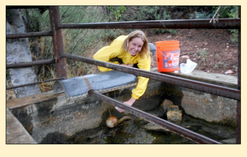
- **35 percent of sites exceeded Primary MCLs.**
- **57 percent of sites exceeded Secondary MCLs.**
- **38 percent of sites did not exceed any MCLs**.
- **VOCs** and **pesticides had no exceedances**.

#4 – What Are Groundwater's "Big Four"?

More than **98 percent of Primary MCL exceedances** at the 1,766 sample sites were **caused by just four constituents**:

- **Arsenic** at 22 percent of sites,
- **Fluoride** at 11 percent of sites,
- **Nitrate** at 10 percent of sites, and
- **Gross alpha and/or uranium** at 16 percent of the 641 sites at which a radionuclide sample was collected.

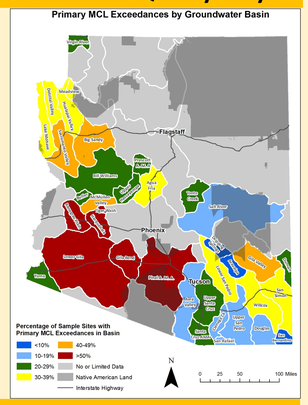
At a minimum, ADEQ recommends testing domestic wells for the "Big Four" constituents and bacteria.



#5 – How Does Arizona Groundwater Quality Vary?

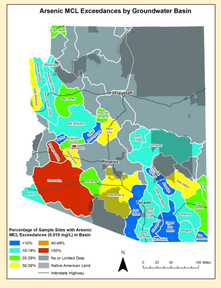
Groundwater basins in Arizona exhibit very different water quality:

- More than **75 percent** of sampled sites in some desert basins in SW Arizona **exceeded Primary MCLs**.
- There were **no such exceedances** in some remote, upland basins in SE Arizona.



#6 – How Do Arsenic, Fluoride, & Nitrate Vary?

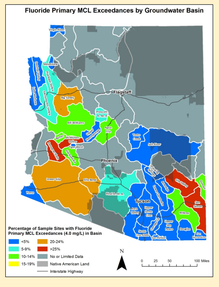
Arsenic and fluoride are naturally occurring and follow similar patterns while **nitrate mostly has anthropomorphic sources**.

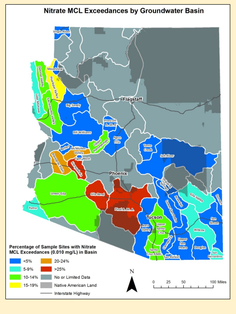


Arsenic exceedances occur in SW Arizona from factors such as the source rock and long residence time that favor the dissolution from aquifer materials.

22 percent of samples sites exceeded the current arsenic water quality standard (0.01 mg/L), only **two percent exceeded** the former standard of 0.05 mg/L.

Fluoride exceedances have a similar pattern but reflect the presence of deep, artesian aquifers in SE Arizona, which may have levels more than twice the 4.0 mg/L standard.



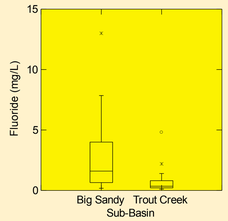


Nitrate exceedances on a regional scale are associated with agricultural fertilizer use. Wastewater discharges from septic systems impact water quality, but usually only locally.

#7 – How Does Groundwater Quality Vary Within Basins?

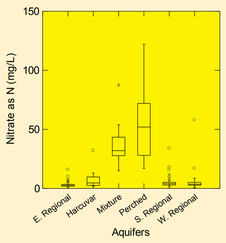
There is often a **high intra-basin variability with groundwater quality** when compared by sub-basins, aquifers, physiographic areas, watersheds, groundwater age, and geology.

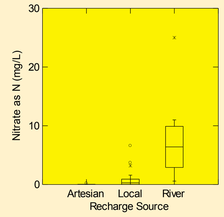
Intra-basin comparisons identify water quality threats for domestic well owners.



In the **Big Sandy** basin, **fluoride** levels are significantly different **among sub-basins**.

In the **McMullen Valley** basin, **nitrate** levels are significantly different **among aquifers**.





In the **Safford** basin, **nitrate** levels are significantly different **among recharge sources**.

#8 – What Are ADEQ's Groundwater Monitoring Goals?

#1 – Characterize the remaining 18 groundwater basins in Arizona.

#2 – Resample a subset of wells in each basin for time-trend analysis.

#3 – Link the ADEQ program to the U.S. Geological Survey's National Groundwater Monitoring Network.

Hurdle to Achieve Goals: There's only one hydrologist in the program.

Contact information:
Douglas Towne – dct@azdeq.gov
Jason Jones – jdj@azdeq.gov